REMARKS

Applicant acknowledges, with appreciation, the indication that claims 19 and 20 contain allowable subject matter. Claims 1, 3-15 and 17-23 are now pending in this application, with claims 1, 21, 22 and 23 being the independent claims. Claims 1, 3-5, 10-12 and 20 have been amended. The amendments to the claims clarify their wording, and are cosmetic in nature. No new matter has been added. Reconsideration of the above-identified application, as amended, is respectfully requested.

In the Office Action dated March 27, 2006, independent claims 1 and 21, and dependent claims 3-15, 17 and 18 were rejected under 35 U.S.C. §103(a) as unpatentable over U.S. Patent No. 6,522,696 ("*Mobin*") in view of U.S. Patent No. 5,579,345 ("*Yasuda*"). For the following reasons, it is respectfully submitted that all claims of the present application are patentable over the cited references.

The Examiner has cited *Kroeger* based on the failure of *Mobin* to teach "means for converting [a] digital control signal into an analog control signal for controlling a mixing frequency". *Yasuda* has been cited to teach this feature. However, Applicant respectfully asserts that the combination of *Mobin* and *Yasuda* fails to teach or suggest the claimed invention.

Mobin teaches a system in which a received signal is down-converted using a mixing frequency provided by a crystal oscillator. The down-converted signal is then converted by a analog-to-digital converter (ADC) into a digital signal and processed in the digital domain. This processing includes correcting for any residual frequency mismatch between the transmitted signal and the mixing frequency produced by the crystal oscillator.

Mobin, however, fails to teach or suggest that this mixing frequency could be varied, either in response to conditions (e.g. temperature, relative movement of a transmitter and receiver, or the age of the receiver), or to "tune" the receiver to a different channel. Consequently, *Mobin* teaches that the down-converted signal can vary in frequency over a large range. This requires the ADC to have a higher sampling frequency, which significantly adds to the cost and complexity of the receiver. As a result, conventional receivers of the type disclosed in *Mobin* are utilized in which the mixing frequency is provided by a digital-to-analog (DAC) converter. This DAC receives a digital control signal specifying a frequency, and provides an analog signal (corresponding to a digital control signal) to the mixer.

Yasuda also teaches such a system, where a DAC (19) provides a variable analog frequency to a mixer (13). In general, *Yasuda* teaches an A/D conversion and radio apparatus for

obtaining highly accurate frequency conversions without possessing the characteristics of low distortion and low noise for a wide range of input levels, while the number of quantized bits of the A/D converter is large (see col. 2, lines 48-53). However, the Examiner's attention is directed to the similarities between Fig. 2 of the present application and Fig. 1 of *Yasuda*. That is, *Yasuda* describes a system that is substantially similar to the prior art disclosure of the present claimed invention. Therefore, it is evident that the combination of *Mobin* and *Yasuda* achieves a receiver in which the received signal is down-converted, converted into the digital domain and <u>digitally processed</u>. The analog mixing frequency used in the down-converter is provided by a DAC controlled by the digital processing. The digital processing corrects for any mismatch in frequencies between the received signal and the analog mixing frequency.

Such a circuit is shown in Figure 2 (the prior art disclosure) of the present application. However, the present inventor has realized that there are problems with such a circuit. First, the discrete nature of a digital signal entails that the analog frequency provided by the DAC will vary in discrete "steps", rather than on a continuous basis. The use of a longer word for the digital control signal can reduce this step size. However, the use of a longer word increases the cost and complexity of the receiver circuit. Consequently, a receiver, as industrially applicable, will use a shorter word and will consequently provide an analog signal with a substantial "step size" (i.e. the change in frequency in the analog domain relating to a one unit change in the digital control signal). This, however, leads to what is known in the art as "quantatization noise".

Secondly, due to, for example, changes in conditions (e.g. temperature) and aging of the receiver, the analog frequency provided by the DAC will vary in relation to a given digital control signal. Consequently, the DAC will, in use, provide an analog signal having a "step size" which is both large and variable in size. As a receiver tracks a given signal, the digital processing will correct for small frequency mismatches between the received signal and the analog mixing frequency. If the mismatch increases, the receiver will then be required to change the analog mixing frequency. As stated, due to the large and variable "step size", the frequency mismatch between the received signal and the new analog mixing frequency will be unknown. As a result, the receiver may "miss" a portion of the received signal, or even lose acquisition of the received signal entirely.

In order to avoid the foregoing problems, the claimed invention utilizes a receiver that is configured to "estimate the difference between the levels of successive ones of [an] analog

control signal". Neither *Mobin* nor *Yasuda* recognize this problem. As a result, *Mobin* and *Yasuda* fails to teach or even suggest the solution provided by the present claimed invention.

The Examiner cites col. 7 of *Mobin* to disclose "estimating the difference between the levels of successive ones of said control signal". *Mobin* (col. 7, lines 60-64) states, "synchronizer 52 provides a coarse frequency offset error or phase delay signal, AFC_F_synch, at predetermined intervals, which is an estimate of the frequency offset between the frequency of the local oscillator and that of the transmitted signals". *Mobin* (col. 8, lines 6-8) further states, "synchronizer 52 responds to a series of predetermined binary bits such as zero's, known as frequency correction bits 'FCB's. These FCB bits are transmitted by a transmitter at predetermined intervals". *Mobin* thus teaches measuring and correcting for the frequency mismatch between the received signal and the mixing frequency provided by the crystal oscillator. Accordingly, *Mobin* teaches "estimating the difference between the received signal and a control signal" (the control signal being provided by the crystal oscillator). However, *Mobin* fails to teach or suggest that the difference between the levels of <u>successive ones</u> of an analog control signal is estimated, as recited in independent claim 1.

Additionally, *Mobin* teaches that <u>all</u> control signals are in the <u>digital domain</u>. As a result, *Mobin* fails to teach or suggest, nor is there any need for, estimating the difference between the successive control signals. In the digital domain, the value of a control signal is absolute; it is only upon conversion to the analog domain that uncertainty (and the requirement to estimate differences) is introduced. *Mobin* thus fails to teach that that the difference between the levels of <u>successive ones</u> of said analog control signal is estimated, as recited in independent claim 1. Moreover, the combination of *Mobin Yasuda* fails to teach or suggest this feature.

As stated previously, the portion of *Yasuda* cited by the Examiner relates to the prior art disclosure of Applicant's present claimed invention. The stated purpose of *Yasuda* is to provide an "ADC apparatus and a radio apparatus to easily realize a frequency conversion function of high accuracy" (see col. 2, lines 48-51). The differences described in *Yasuda* over the prior art (as recognized in *Yasuda*) relates to the function of the ADC. Accordingly, *Yasuda* teaches nothing with regard to the claimed invention. Consequently, the combination of *Mobin* and *Yasuda* fails to achieve the invention recited in independent claim 1, since *Yasuda* fails to teach or suggest what *Mobin* lacks.

In sum, when a digital signal is converted into the analog domain, a degree of uncertainty is introduced. The skilled person in the art would readily appreciate that this presents a problem.

The claimed invention is directed to measuring this uncertainty so as to solve this problem. *Mobin* fails to disclose that a digital signal is converted into the analog domain, and consequently fails to teach measuring any sort of uncertainty. On the other hand, *Yasuda* teaches the conversion of a digital signal into the analog domain, but fails to recognize or solve the problem of the uncertainty in the analog signal. Therefore, *Mobin* and *Yasuda*, individually or in combination, fail to teach or suggest the claimed invention, as recited in independent claim 1. Independent claim 1 is thus patentable over the combination of *Mobin* and *Yasuda* and, therefore, reconsideration and withdrawal of the rejection under 35 U.S.C. §103 are in order, and a notice to that effect is earnestly solicited.

Independent claim 21 is the method associated with the system of independent claim 1. Newly added independent claim 22 is an apparatus claim associated with independent claim 1. Independent claim 23 is the computer program product associated with independent claims 1, 21 and 22. Accordingly, independent claims 21-23 are patentable over the combination of the cited references for the reasons discussed above with respect to independent claim 1.

In view of the patentability of independent claims 1 and 21, as well as new independent claims 22-23, for the reasons set forth above, dependent claims 3-15 and 17-20 are all patentable over the prior art.

Based on the foregoing amendments and remarks, this application should be in condition for allowance. Early passage of this case to issue is respectfully requested.

Respectfully submitted,
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